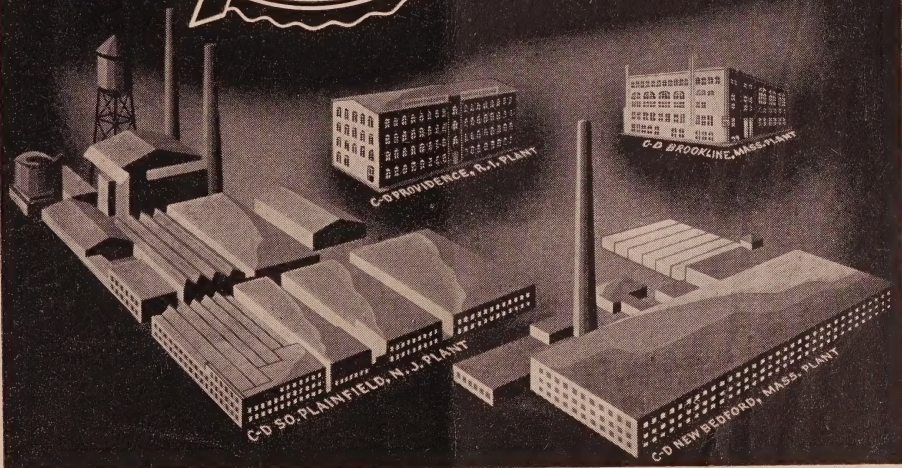


The CORNELL-DUBILIER *Capacitor*



Vol. 14

DECEMBER, 1949

No. 12

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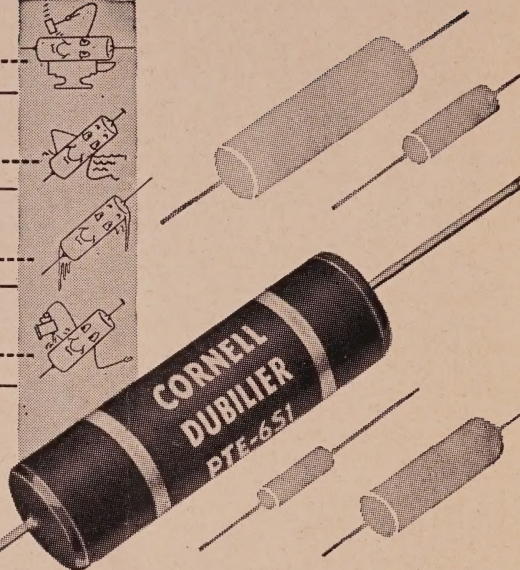
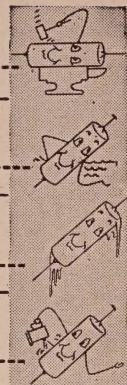
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HIGH-SENSITIVITY AF-RF SIGNAL TRACER

The signal tracing technique is well established at this time in radio and amplifier trouble shooting. Untuned tracing instruments enjoy wide popularity because of their comparative simplicity and the speed with which they may be used. The radio service literature has described many signal tracer designs during the last two years.

The instrument described in this article is an untuned signal tracer having important advantages: (1) It possesses unusually high, adjustable sensitivity; (2) its single test probe may be used without switching of any kind to pick up signals from either r.f., i.f., or audio

stages; and (3) it provides audible (loudspeaker) as well as visual (meter) indications. The latter features enable the trouble shooter to determine not only the strength of the signal in a circuit stage, but the nature of the signal (or interference) as well, by listening tests. Using miniature tubes in all except the power rectifier stage, this instrument is small in size, lightweight, and may be built economically by the radio man. It is not a complicated device.

The sensitivity of this signal tracer is such that a signal of slightly less than 1 millivolt applied to the pickup probe

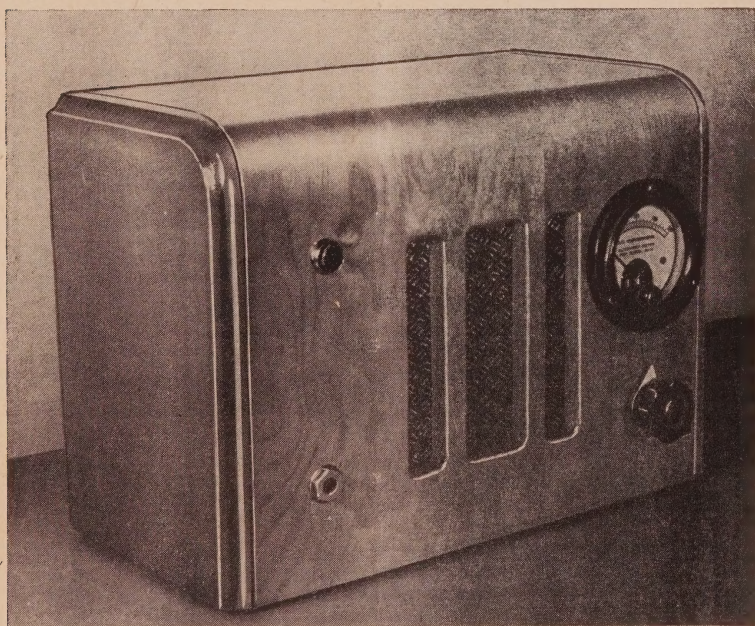
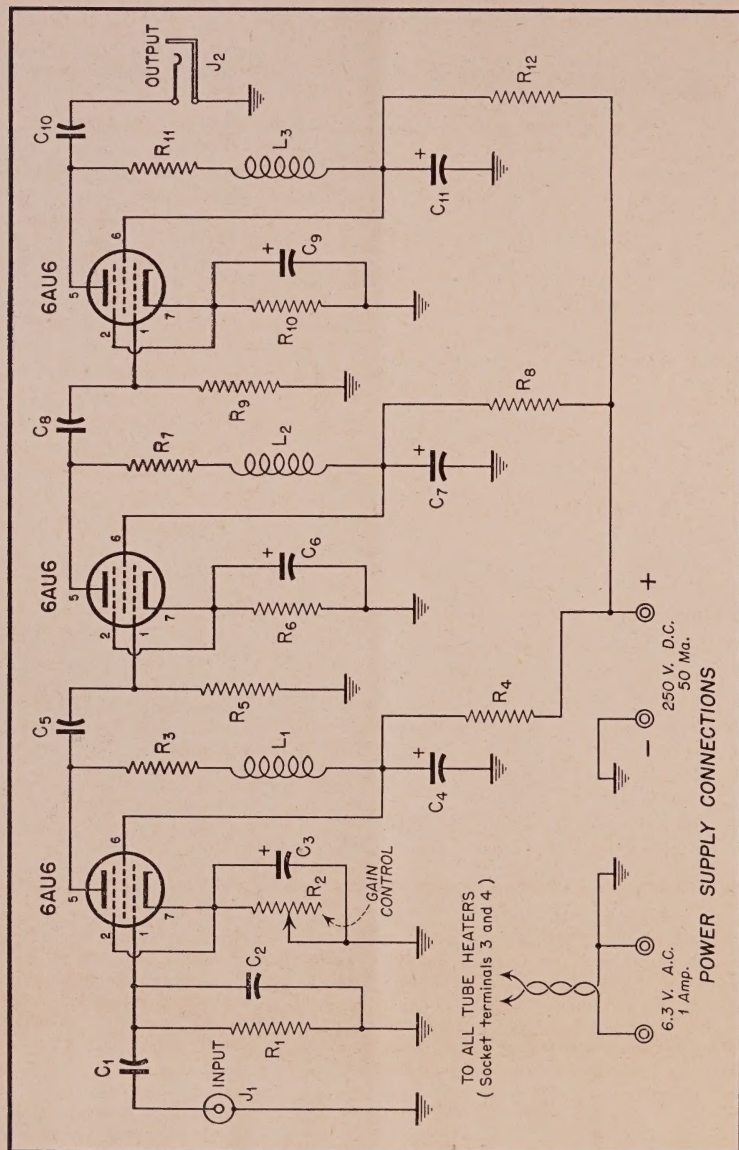


Fig. 1.



List of Parts

- | | |
|--|--|
| <p>C₁—5 ufd. 50 d. c. w. v. midget tubular electrolytic — C-D BR550</p> <p>C₂—0.1 ufd. 400 v. tubular — C-D PTE-4P1</p> <p>C₃—0.006 ufd. mica — C-D 1D 5D6</p> <p>C₄—8 ufd. 450 d. c. w. v. tubular electrolytic — C-D BR845</p> <p>C₅—5 ufd. 50 d. c. w. v. midget tubular electrolytic — C-D BR550</p> <p>C₆—0.1 ufd. 400 v. tubular — C-D PTE-4P1</p> <p>C₇—0.006 ufd. mica — C-D 1W-3D6</p> <p>C₈—10 ufd. 50 d. c. w. v. midget tubular electrolytic — C-D BR105</p> <p>C₉, C₁₀—0.1 ufd. 400 v. tubular — C-D PTE-4P1</p> <p>C₁₁, C₁₂—Dual 8-ufd. 450 d. c. w. v. tubular electrolytic — C-D BRL 8845</p> <p>CH—Midget 15-henry, 100-ma. filter choke — U. T. C. R-19</p> <p>J—Miniature closed-circuit phone jack</p> <p>M—0-200 d. c. microammeter</p> <p>R₁—$\frac{1}{2}$-megohm potentiometer — I. R. C. Type CS with switch</p> <p>R₂—1,000 ohms 1 watt carbon — I. R. C. BT-1</p> <p>R₃—200,000 ohms $\frac{1}{2}$ watt carbon — I. R. C. BT-$\frac{1}{2}$</p> <p>R₄—100,000 ohms 1 watt carbon — I. R. C. BT-1</p> | <p>R₅—50,000 ohms 1 watt carbon — I. R. C. BT-1</p> <p>R₆—$\frac{1}{2}$ megohm $\frac{1}{2}$ watt carbon — I. R. C. BT-$\frac{1}{2}$</p> <p>R₇—1,000 ohms 1 watt carbon — I. R. C. BT-1</p> <p>R₈—200,000 ohms $\frac{1}{2}$ watt carbon — I. R. C. BT-$\frac{1}{2}$</p> <p>R₉—100,000 ohms 1 watt carbon — I. R. C. BT-1</p> <p>R₁₀—$\frac{1}{2}$ megohm $\frac{1}{2}$ watt carbon — I. R. C. BT-$\frac{1}{2}$</p> <p>R₁₁—250 ohms 2 watts carbon — I. R. C. BT-2</p> <p>R₁₂—25,000 ohms $\frac{1}{2}$ watt carbon — I. R. C. BT-$\frac{1}{2}$</p> <p>R₁₃—10,000 ohms 25 watts wirewound, with slider — I. R. C. DHA</p> <p>S—S. p. s. t. switch attached to potentiometer R₁</p> <p>SPKR—4-inch PM dynamic speaker — Quam 40PM</p> <p>T₁—Output transformer: 8 watts 5,000-ohm plate to voice coil — Utah 7364</p> <p>T₂—Power transformer: 375-O-375 v., 100 ma.; 6.3 v., 3 A.; 5 v., 3 A. — U. T. C. R8</p> <p>1N34—Sylvania Type 1N34 germanium crystal diode (Caution: Do not use a silicon diode in this application)</p> |
|--|--|

will produce full-scale deflection of the indicating meter and will give full loudspeaker output when the sensitivity (gain) control is set to its maximum position. This high degree of sensitivity permits adequate signal pickup by the instrument even at the antenna terminals of a receiver or the input terminals of an amplifier under test. The signal may be followed easily through every stage, the operator being

required only to transfer the pickup probe from point to point through the circuit and to reduce the gain control setting as the signal strength increases in the various stages.

A conventional transformer-type a. c. power supply is employed. This removes completely the electric shock hazard and tendency to pick up hum interference which are experienced with AC-DC-type signal tracers.

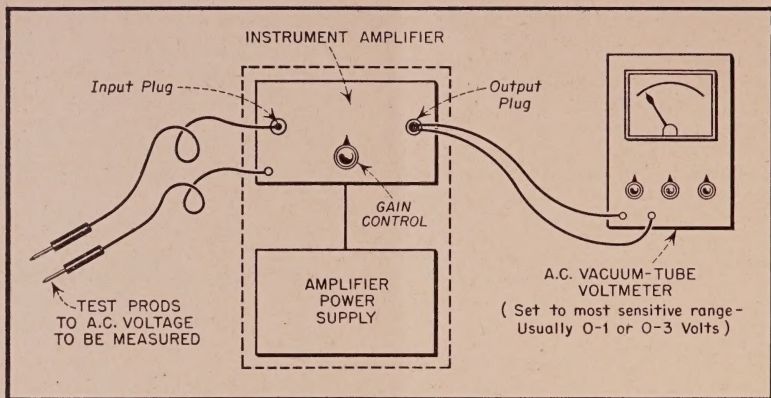


Fig. 3.

The output meter is linear in indication, which means for example that a 2-to-1 increase in meter reading at a given setting of the gain control shows a 2-to-1 increase in signal voltage.

Figure 1 is an external view of the completed signal tracer. Visible in this photograph are the pilot light and probe jack on the left-hand side of the face, speaker grille in the center, and 2-inch output meter and sensitivity control knob on the right-hand side. This illustration shows the instrument to be of small size, requiring very little bench space.

Instrument Circuit

Figure 2 shows the complete circuit diagram of the signal tracer. Figure 3 is the circuit of the external AF-RF test probe.

The shielded shell-type handle of the test probe contains a shunt-diode detector circuit based upon a type 1N34 germanium crystal. Silicon-type crystals (such as 1N21, etc.) are not recommended for this application, since they are damaged easily by the high signal voltages which often are accidentally encountered in signal tracing. The purpose of the probe detector

is to demodulate the test signal of the modulated r. f. signal generator used in the signal tracing operation. When shooting trouble in PA amplifier systems, an audio oscillator is substituted for the signal generator, and the probe detector merely separates the positive peaks from the audio waveform. It accordingly need not be switched out of the circuit when making AF tests. The output of the probe detector is fed through a shielded cable to the input of the tracer circuit, through jack J.

The main circuit (See Figure 2) will be recognized as that of a high-gain audio amplifier. Resistance, capacitance, and voltage values in the two 6AU6 pentode voltage amplifier stages have been chosen to give a practical overall gain of approximately 10,000 for the two stages. The sensitivity (gain) control, R_1 , is placed in the input grid circuit.

The 6AQ5 beam power output stage drives the loudspeaker. The output voltmeter circuit, comprised by a second 1N34 germanium crystal diode, multiplier resistor R_{12} , and 0-200 d. c. microammeter M, monitors the audio output voltage across the speaker voice coil.

The power supply portion of the circuit is entirely conventional, being of the transformer type with capacitor-input filter. The voltage divider, R_{13} , allows the d. c. output voltage to be set exactly to 250 volts. The power-line bypass capacitors, C_9 and C_{10} , reduce hum and interference pickup from the line and are essential in a high-gain circuit of this type. A decoupling filter (made up of C_4 and R_5) eliminates interaction between the two 6AU6 stages.

Construction

The tracer is housed in a wooden "intercom" cabinet, 11 inches long, $7\frac{1}{2}$ inches high, and 5 inches deep. While the author found it convenient to use this type of enclosure chiefly because it had a ready-cut speaker opening, the reader may use any other form of case or cabinet he prefers. The unit is built on an $8\frac{1}{2}$ " x $4\frac{1}{2}$ " x $1\frac{1}{2}$ " metal chassis. The loudspeaker is a 4-inch PM dynamic unit.

The test probe is made from a $3\frac{1}{2}$ -inch length of 1"-diameter aluminum tubing provided with metal end caps and an insulating end disc. The probe rod is made of $1/16$ "-diameter brass rod threaded at one end and pointed at the other.

The power transformer (T_2), filter choke (CH), and 5W4 rectifier tube must be mounted on the end of the chassis nearest the 6AQ5 tube, in order that they will be spaced as far as possible from the first 6AU6 tube. The output transformer (T_1) is placed close to the 6AQ5 tube and is mounted with its core at right angles to the cores of the power transformer and filter choke.

The two 6AU6 tubes and the 6AQ5 must be mounted in shielded sockets with tube shields. Wiring from input jack J to potentiometer R_1 and from R_1 to the grid of the first 6AU6 tube must be enclosed in shield braid grounded at both ends of its length. The metal plate on the back of potentiometer R_1

must be grounded to the chassis by means of a heavy lead.

For maximum stability and minimum hum pickup, all ground returns in each of the 6AU6 stages must be run to one common point, such as a lug bolted tightly to the chassis. By this, we mean that in the first stage, the "ground return" leads of J, R_1 , R_2 , C_1 , C_2 , and C_4 must be connected to *one* chassis lug. And in the second stage; R_6 , R_7 , C_5 , and C_6 similarly must be returned to one lug. All tube heater leads must be twisted tightly together and held snugly to the chassis by means of soldering lugs bent to serve as clamps. One side of the 6.3-volt heater line is grounded solidly to chassis to remove heater hum.

Interstage wiring must be kept as short and direct as possible. Use insulated, *solid* hookup wire for rigidity. Wherever possible, leads of the circuit components themselves should be connected directly between tube socket contacts without additional wires. Thus, one pigtail of coupling capacitor C_3 is connected directly to the plate (No. 5 contact) of the first 6AU6 socket, while the second pigtail goes to the grid (No. 1 contact) of the second 6AU6. Make all connections tight mechanically before applying solder to them.

Take the time to mount all parts solidly. This applies particularly to the transformers and filter choke which must be bolted tightly to the chassis, using lock washers and screws not smaller than 10-32. This will save much future annoyance which might arise from vibration of these components. It is, of course, highly desirable to have any instrument which is to be used for trouble shooting in other devices completely trouble-free itself.

Observe correct polarities of the microammeter (M) and the 1N34 crystal lead marked CATH must be connected diode which supplies it. The diode toward the positive terminal of the

meter. If either the diode or the meter is reversed, the meter will be deflected backward by a signal.

In the test probe (See Figure 3), keep all wiring rigid. A 2-foot length of standard microphone cable will be satisfactory for connection between the probe and the phone plug. This cable is very limp and accordingly facilitates handling of the probe during tests. A metal-shelled plug, such as used with crystal microphones, is suitable for the end of the cable.

Testing and Using the Tracer

After the wiring has been completed; place the tubes in their sockets, plug the unit into an a. c. power line, and switch-on the power keeping sensitivity control R_1 turned all the way down. With a high-resistance d. c. voltmeter (at least 1,000 ohms per volt, but preferably higher), set the slider on resistor R_{12} to give exactly 250 volts between the slider and ground (chassis) when the tubes are fully heated. (To prevent electric shock, turn the power off each time the slider is to be moved, and switch it on again to read the voltage at the new slider setting).

Now; advance R_1 to its maximum setting. At this point, very little hum or tube hiss should be heard in the loudspeaker, and meter M should not be deflected from zero. Insert the probe-cable plug into jack J. Connect the output of an AM signal generator to the probe input terminals. Set the generator to any convenient frequency and be sure that the signal is modulated. As the output control of the generator is turned up, the audio modulation tone should be heard in the loudspeaker and the meter should be deflected upward.

For tracing signals in a radio receiver; connect a modulated signal generator to the antenna input terminals of the receiver under test. Set the generator to any convenient frequency

within the tuning range of the receiver. Set the receiver dial to the generator frequency. Clip the ground clip of the signal tracer probe to the receiver chassis. Touch the probe prod first to the receiver antenna terminal, noting the amount of meter deflection and the loudness of the signal in the tracer speaker. Advance setting of R_1 if necessary to obtain a readable deflection. Now; transfer the prod to the grid of the 1st detector or 1st r. f. amplifier (whichever is the antenna stage in the receiver under test), retune the dial if necessary for maximum swing of the meter, and note new peak meter reading. Touch the prod successively to the grid and plate terminals of each tube in the receiver, working systematically through the receiver starting with the antenna stage and ending with the audio output stage. To check the final output, connect both the prod and clip to the two voice coil terminals of the loudspeaker in the receiver. In each successive stage, the signal normally will undergo some amplification, necessitating reduction to the R_1 setting to prevent "pinning" the meter.

The tracer is used in the same way to check an audio amplifier, such as a PA system, except that the signal must be supplied in this case by an audio oscillator. Work through the amplifier circuit, stage by stage, successively from the low-gain input to the output stage.

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32R8	32	110 V 60 cycle	80	Farm and Marine	6¼ x 7¾ x 5¾	13¼	48.50	29.10
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SWAP—Radio Diagrams, including Philco, Truetone, Superior, from 1929 to 1946. Want 8mm movie films. Harry J. Shroyer, 815 So. 15th St., St. Joseph 36, Mo.

FOR SALE OR TRADE—BC348N rec., converted to 115V ac; Silver 701 xmitter with 10 and 20 meter coils. Want ham equip. or cash. Make offer. Gilbert Watson, 1008 Samson Ave., Alabama City, Ala.

FOR SALE OR TRADE—Vomax 900, used very little, with instructions for operation, \$35, or trade for photographic or test equip. F. Fellows, 45-27 170th St., Flushing, N. Y.

FOR SALE—25B8 tubes, factory boxed, \$3.80 each or what have you? H. M. Love, 4993 Grace Road, North Olmsted, Ohio.

FOR SALE—Universal tube and set tester, like new, sells for many times more. First \$35 money order takes it. David Garnick, 38 Burt St., Lowell, Mass.

FOR SALE—A Hallicrafter S-55 radio cabinet, like new, will take S-56 chassis, \$10. Stanley J. Hlastava, 42 Canal St., Jewett City, Conn.

SELL OR SWAP—Compass 35mm precision camera, coupled range-finder, built-in filters, carrying-case, all in first class cond., cost \$250 new. Want HQ-129X or SX 28 receiver. Will consider test equip-in exchange. Paul G. Moore, P.O. Box 1123, Washington 13, D. C.

WANTED—Any used post-war emission type tube tester; must be reasonable and in good condition. State mfr, model No., age, and price. Also want post-war F.M. tuner. O. E. Radke, 3801 N. Newhall St., Milwaukee 11, Wis.

FOR SALE—5" scope, sensitivity of .5 V per inch, \$50; VTVM 0-1000V ac-dc 0-100 meg. in 5 ranges, \$35; GE YGA-4 0-1000 cy audio sig. gen., \$40; AM-FM ivory table model radio, 8 tubes plus sel. rect., \$45. Richard F. Reed, 2054 Bradley, Ypsilanti, Mich.

SELL OR TRADE—Hammarlund BC 779, Super Pro excellent condition. \$125 or trade even for HQ 129x or NC173. B. Holubiczko, 249 Rutledge St., Brooklyn 11, N. Y.

FOR SALE—BC-455 command receiver, converted and in new condition, power supply built on back dynamotor deck, compact, all tubes are brand new, complete for operation on 117V ac, \$18. James Pullman, 834 Edison Ave., Detroit 2, Michigan.

TRADE—Edison's first home gramophone, with tin horn, 23 cylindrical type records, works and plays like new. Want TV set or sound movie projector. Fred Simonian, 85 Shepard St., Lynn, Mass.

FOR SALE—Free gift to those who send and get list of things I have to sell! Nothing to buy! Cameras, projectors, films, radio supplies, many other things! Tell me what you want - I'll send you my offer! Gregorie Ficara, Jr., 15 Furnace St., Springfield, Vermont.

FOR SALE—BC 348 R radio receiver, new, converted to 110V ac, dynamotor and headphones included, \$65. All inquiries answered. Robert Glenn, 108 E. Middle St., Hanover, Pennsylvania.

FOR SALE—High-Precision VTVM, Eico, model 221-K, exceptionally accurate, brand new, \$45. Peter Kacoure, 148-09 Jamaica Ave., Jamaica 2, N. Y.

FOR SALE—NC-240D rec. complete with matching speaker in cabinet, clean, \$140; Meissner portable radio-phonorecorder, \$110. Equip. is 1 year old, recently checked. S. M. Bassham, c/o E. L. Smith, 3428 Bapaume Ave., Norfolk, Va.

SELL OR TRADE—Vols. 1, 2, 3, 4, Howard Sams, \$12. each, like new. Vols. 1, 2, 3, 4, 5, Riders, excellent cond., \$35 complete, no individual vols. for sale. Need VTVM, consider trade. Clifford D. Lessig, 30 Fifth St., Frenchtown, N. J.

SWAP—Graig 16mm 8mm viewer, 2 1600' Griswald rewinds, splicer, mike, good cond., cartoons, short subjects and 2 features 16mm sound. Want typewriter, oscilloscope, or what have you, Frank Siegel, 107 Rodney St., Brooklyn 11, N. Y.

FOR SALE—Electronics, all 1939 and Jan., 1940; proceedings of the I.R.E., all 1939. All in new condition, first reasonable offer takes them. Arnold J. Ely, 2884 Michigan Ave., Niagara Falls, N. Y.

FOR SALE—Precision model 612 tube and battery tester, counter model, new; Superior 600 tube and set tester, portable cases; Aerovox capacitor and resistance checker; McMurdo-Silver test speaker; Feiler TS2 professional sig. tracer; 200 latest tubes. F. Merrill, 493 East 164th St., New York 56, N. Y.

FOR SALE—Superior 600 tube-set tester, Superior 650 sig. gen., purchased last year. Both instruments \$55, or will sell separately. James Hurst, 22 June St., Fall River, Mass.

TRADE—Japanese naval compass, German exposure meter, Agfa camera, wide variety of watchmaking tools, parts and watches. Want good communication rec., test equip., or what have you? H. Balk, 1765 Townsend Ave., Bronx 53, N. Y.

TRADE—Volumes 1 thru 9, Riders' Manuals, excellent condition. Want good record changer and amplifier, or reasonable cash offer. Gene W. Dean, 970 N. E. 117th St., Miami, Florida.

TRADE—Feiler model TS2 sig. tracer, 4 meters, 2 tube ac SW set; NRI VTVM tester. Want new tubes and parts, or what have you? T. Rohland, RR 1, Paragon, Ind.

SWAP—NRI lessons text books. Want used radio tester. Harold M. Pannell, 110 Campbell St., E. Gadsden, Ala.

FOR SALE—Army model Super-Pro, 14 tubes, crystal filter, 540kc-20mc, home built 10 meter broad band converter (6J4, 6J6), power supply, needs "S" meter and speaker, \$98. Also small parts, meters, tubes, etc. M. Herbstman, 1806 Sterling Place, Brooklyn 33, N. Y.

FOR SALE—Nearly new Newcomb Hi fidelity portable sound system, with phono for 78 and 33 1/3, \$125; Garrard intermix record changer with GE cartridge, \$75; new Victor portable phonograph sound system for microgroove and regular records, \$25. J. Kingsley, 622 Alpine St., Dubuque, Iowa.

BUY SELL OR SWAP—Radio tubes and filter condensers for others. Send your list. Sell RMS Booster, \$16.50. 8-tube Brewster FM converter complete, having 42-50 scale, \$10.00. Used Premier vacuum cleaner, \$8.50. Andrews, 740 Maple St., Bethlehem, Pa.

FOR SALE—Hickok 288X. Bought new, used less than two hours. Priced for quick sale \$110, cash. R. Hertzberg, 2512 84th St., Jackson Heights, N. Y.

WANTED—Impedance bridge, G.R. 650-A, or Brown 250-A or 275-B. State price and condition. S. V. Hart, 205 Donovan Building, Detroit 1, Mich.

FOR SALE—Pilot F.M. tuner, like new, \$12.50; Brush P.L. 20 transcription arm (16") less equalizer, \$12.50; Extra cartridge for PL 20, \$5.00. All above in original cartons. Sam N. Narefsky, 4031 48th St., Long Island City 4, N. Y.

WANTED—Oscilloscope and No. 20 tube. R. S. Komp, Meridian, N. Y.

WANTED—115 volts AC to 6 volts DC power supply for servicing auto radios. State make, model, and lowest price. M. Herman, 417 Raritan St., Camden 5, N. J.

FOR SALE — Gardiner code automatic sender with ten rolls of practice tapes. Electric motor driven; variable speed. \$16 or best offer. R. Jos. Flowers, 33 North 18th St., Harrisburg, Pa.

FOR SALE OR TRADE—Rider's Manuals 1-15 (15 volumes) \$150. Workshop 20 Meter, 3 element beam, electric rotator, indicator, and cable, \$150. BC221-M Freq. meter \$30. Simpson 260 multi-tester, \$25. Precision EV-10P with RF10 probe \$85. Wallace Cashwell, 803 E. Lake, Tampa, Fla.

WANTED— For cash, Hallicrafter's HT-9 or Collin's 32V1 transmitter. State condition and price. J. P. Andrasko, 223 East 96th St., New York 28, N. Y.

FOR SALE OR SWAP—Philco 027 combination VOM VTVM in excellent condition, \$30. Also Barbell with 2-25 2-20 and 2-12 1/2 lb. plates, York Course and Iron Boots. S. Rand 54 Elm St., Plattsburg, N. Y.

FOR SALE—Model 3212 Triplett tube tester, \$50; New RME 45 Presselector, \$175; Telrad freq. standard, \$25; K8 Presto recorder, \$250; 10 meter antenna, \$15; RCA modulation transformer, 1kw, \$16; Hickok traceometer, \$125; Webster phono motor and turn table, \$3.75. Kenneth A. Jones, 2450 Pearl St., Dubuque, Iowa.

FOR SALE—Altec Lansing Hi-Fidelity Amplifiers type A126 and A422A and deluxe crackle finish cabinet 35" table type, all for \$150, no trades. Erwin Tomash, 3848 Florence Dr., Alexandria, Va.

SELL OR TRADE—Browning A-30 Signal Generator Range 22-38 MC/sec Audio Freq. 900 to 1100 cycles adjustable. Perfect for television I.f.s. Best offer, or would like pocket volt, ohm meter, or other test equipment. West Pine Radio Service, 95 West Pine St., Gloversville, N. Y.

FOR SALE—BC-474 A transceiver with tubes, exc. cond. Code practice set, surplus, 6, 12, 24, v. D-C 115 230 V. A-C 115 v. DC 14 Watt Amplifier, sound powered phones. Write for price and details. Private, will sell items very cheap. A. Aronstein, 615 Pelham Pkwy. No., Bx. 67, N. Y.

FOR SALE—Two battery operated Mantola table model radios, model R643-W. Want good signal generator, oscilloscope or communications receiver. Also need good late model tube tester. I. L. Lambert, 1037 Oaklawn St., N. E., Grand Rapids 5, Mich.

FOR SALE—Closing shop. Everything must go. Hickok test equipment and service manuals like new. A real bargain for somebody who wants to open a shop. Send for complete list. George Rainer, 2160 Newbold Ave., New York 61, N. Y.

TO TRADE—Model 120 Burke & James $2\frac{1}{4} \times 3\frac{1}{4}$ condenser enlarger. Wollensak Vellostigmat f3.5 lens. Excellent condition. Swap for 5" scope in good condition. Harold H. Hingley, Rt. 2, Box 40, Holtville, Calif.

FOR SALE—RCP model No. 668, vacuum tube, voltohm capacity meter, with two sets of test leads, and operating instructions, \$45. Stephan Gromada, 725 E. 9th St., New York 9, N. Y.

FOR SALE—Supreme Oscilloscope Model No. 546. Excellent condition. \$20 FOB Harrisburg, Pa. R. Collins, 4 Elmhurst Rd., Highland Park, Camp Hill, Pa.

FOR SALE OR TRADE—BC348R Receiver 110V \$57.50, new ARC-5 xmitter 4 to 5.3 M.C. \$4, BC375 xmitter parts. Want Heath Scope, T.V. Generator or R.F. Signal Generator. R. S. Greenwald, 4929 Escalon Ave., Los Angeles 43, Calif.

FOR SALE—Scr-274N Command Sets, 3 receivers, 2 transmitters, 2 tuning control boxes, antenna coupling box with R.F. meter, four 28 V. dynamotor, Pre-amplifier & Modulator, mounting rack, tuning tables, 29 tubes supplied, \$30. Edward Huey, 49 Bank St., Stamford, Conn.

WANTED—A surplus peaked audio choke No. 70472, 70473, etc. State price wanted. 167 Myrtle Ave., S. I. 10, N. Y.

WANTED—Rider's Manuals 11, 15, 16. Power Converter 110 VAC to 6 volt DC for auto radio servicing. W. A. Mackin, Mackin Radio, 204 15th St., Elyria, Ohio

FOR SALE OR TRADE—17 three way sockets, 14 extension cords, and 30 inverters for operating Haydon timers on coin radios on D.C. current. Two 50L6 tubes per inverter. Practically new. J. P. Epps, 53 Hancock St., Boston, Mass.

SELL OR TRADE—Radio News 1946-47-48-49 complete. Also Radio Manual, Sterling; Radio Engineering, Terman; Modern Radio Servicing, Radio Physics, Course, Ghiradi; Wm. Rosenfeld, 43 W. 57th St., New York 19, N. Y.

SWAP—One Baby Washer, stainless steel tank, motor like new for AC-DC portable radio with RF Stage. Harold F. Jones, 1010 Floral Ave., Schenectady 10, N. Y.

WANTED—Guthman U-17 Receiver. State condition and cash price. A. N. Densem, 221 Lawndale Ave., N. E. Grand Rapids 3, Mich.

FOR SALE—Radio and appliance business in small town. Sales and service. Only service shop in town. Will sell at inventory (approx. \$2,500). Harrison Radio & Appliance, Mantion, Mich.

FOR SALE OR TRADE—130 types 27, 56 39/44 and 26 tubes all in perfect condition. Will accept any ham or service equipment in trade or make cash offer. Fred Levitt., 134-29 218 St., Springfield Gardens 13, N. Y.

POSITION WANTED—Former radio operator. Commercial, amateur licenses. Married, sober, age 30. Desires permanent position service shop. Salary secondary. Have some experience servicing receivers. Sidney Menschel, 21 Morrell St., Brooklyn 6, N. Y.

WANTED—10, 3, or 1 cm. microwave apparatus, waveguide sections, cavity resonators, slotted lines, magnetron and klystron equipment. G. T. Fleisher, 5761 So. Blackstone Ave., Chicago 37, Ill.

SWAP—Riders manuals 12, 13, 14, counter model tube tester, IJ-56 test set, Triplet signal generator 2432; tubes, parts. Want photo equipment or what have you? Philip Dubson, 2869 W. 17th St., Brooklyn 24, N. Y.

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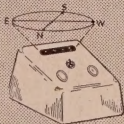
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